

EVALUATION OF A QUALITY PROTEIN MAIZE HYBRIDS AS FEED INGREDIENTS FOR BROILERS

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ABSTRACT

Maize is third important cereal crop next to wheat and rice. Maize used for feed and fodder production because of its nutritional content. It contains 60-70% carbohydrates, 9-11 % crude protein and 2-3.5% crude fiber. In maize, protein content is important for its feed and fodder purpose. Maize protein has a high level of glutamic acid and leucine. Lysine (1.2%) and Tryptophan (0.4%) are limiting amino acids in maize because of storage protein. Quality protein maize derived from the mutant 'opaque 2' which is rich in tryptophan and lysine content. An experiment organized to evaluate the inbreds of UQPM lines for their gene action, combining ability, heterosis, lysine, and tryptophan content. Best performed hybrid lines were used in this study, to estimate the feed efficiency in broilers.

KEYWORDS: QPM, Broilers, Feed efficiency, Lysine, Tryptophan & Opaque 2

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INTRODUCTION

Maize (*Zea mays L.*; 2n=20) is a poor man Nutricereal crop, because of its nutrient content such as carbohydrates, protein, fiber, fats, some of the vitamins and minerals. Maize grains are known for feed ingredients from the olden days onwards. Even though, the normal maize has 8-9% of protein, but they are limited in lysine and tryptophan amino acid. To overcome this problem, QPM evolved from the 'opaque 2' mutant, which is rich in tryptophan and lysine. Using QPM instead of normal maize as feed ingredients are advantageous, especially in monogastric animals. The lysine and tryptophan content of QPM are 0.54 and 0.08 percent, respectively, which is higher than that of normal maize (Ortega *et al.*, 1986; Sproule *et al.*, 1988; Osei *et al.*, 1999). Nutritional studies of QPM proved the rich content of lysine and tryptophan, than normal maize (Bai, 2002; Gao, 2002; Zhai, 2002).

According to the animal feed industry the indigenous maize and soybean are important feed ingredients in all over the world. Particularly in broiler feed ingredients has 60-65% maize, 28-30 % soybean meal and 2-3% oil. Due to the hike in the prices of both maize and soy meal, it reduces the profit rate of the animal feed industry. Anyway, the profit rate of the animal feed industry could be achieved through the supply of QPM. It provides the balanced diet in animal feed and also cheaper compared to soya meal. Hence the QPM enriches protein in feed ingredient and also reduces the cost of price. It acts as a substitute for soy meal also. Many feed trials proved higher feed conversion ratio, especially in broilers (Lopez-Pereira, 1993).

One of our experiments was conducted, to evaluate the UQPM inbred lines for their gene action, combining ability, heterosis, lysine and tryptophan content. UQPM 5, UQPM 11, UQPM 12, UQPM 13 and UQPM 15 inbred lines are taken as female parents, and UQPM 9, UQPM 10 and UQPM 14 inbred lines are taken as male parents. The parental seeds were raised at the Millet Breeding Station, Department of Millets, CPBG, TNAU, and Coimbatore during summer, in three staggered sowing to get synchronization of flowering and for

continuous availability of pollen. Fifteen hybrids obtained from Line X Tester crossing using five lines and three testers as direct crosses. All the hybrids were evaluated along with eight parents and with the normal commercial hybrid COH (M) 5 during Kharif. Among them, three best performed QPM hybrids UQPM 15 X UQPM10, UQPM 5 X UQPM 14, and UQPM 11 X UQPM 9 were taken in this study analysis, on their feed conversion ratio and weight gain analysis in broiler.

MATERIALS AND METHODS

A broiler trial was conducted in a poultry shed located on, Central farm unit, Soil and Crop Management Studies, TNAU, Coimbatore. Best performed three, UQPM 15 X UQPM10, UQPM 5 X UQPM 14, and UQPM 11 X UQPM 9 hybrids were selected based on the information availed through biochemical analysis for crude protein, grain lysine and tryptophan content. Normal Maize in poultry feed was replaced with above best performed QPM hybrids along with COH (M) 5 as a control. To study the feed effect of QPM hybrid grains in comparison with normal maize as feed. Feed ingredients except maize procured locally and mixed with QPM hybrid maize grains. Seven experimental pre-starter (0-2 weeks), starter (3-4 weeks) and finisher (5-6 weeks) diets were formulated (Vencobb standard). Normally, Maize content in the starter was 50 percent and in the finisher, it was about 70 percent. Hence, it is replaced by QPM hybrid maize grains with 50 percent in starter feed mash and 70 percent in the finisher.

Before receiving checks, the poultry house was cleaned and disinfected with 5% formalin. Then the litter materials, namely paddy husk were spread about 5 cm thicknesses and also spread old newspaper over the litter, to prevent the baby chicks from eating the litter. Galvanized steel guards were arranged to a height of 40-45 cm in a hexagonal fashion. Then one hundred and eighty commercial day-old broiler chicks (Vencobb) were purchased and reared inside the brooder. Sufficient lights were provided. The only Pre starter feed was given to the chicks for ten days. On the eleventh day, they were distributed to 4 treatments (T₁ to T₄) groups, each consisting of three replicates, 15 chicks in each. Seven experimental pre-starter (0-2 weeks), starter (3-4 weeks) and finisher (5-6 weeks) diets were formulated (Vencobb standard). Normally Maize content in the starter was 50 percent and in the finisher, it was about 70 percent. Hence it was replaced by QPM hybrid maize grains with 50 percent in starter feed mash and 70 percent in the finisher.

RESULT AND DISCUSSIONS

The mixing ratio of QPM hybrids of feed ingredients is furnished in the Table 1. The performance of broilers in terms of body weight gain, feed intake and feed conversion ratio was studied in 0-2, 3-4, 5-6 and 0-6 weeks (Table 2). The mean feed efficiency of broilers at second week was 1.68, 1.51, 1.55 and 1.67 for T₁, T₂, T₃ and T₄ groups respectively. A better feed efficiency of 1.51 was observed in T₂ (fed with UQPM5 X UQPM14). The groups fed with T₃ recorded feed efficiency of 1.55. A lower feed efficiency of 1.68 and 1.67 was observed in T₁ and T₄ respectively. The mean feed efficiency of broilers at third week was 1.41, 1.44, 1.49 and 1.53 for T₁, T₂, T₃ and T₄ groups respectively. A better feed efficiency of 1.41 was observed in T₁ (fed with UQPM 15 X UQPM 10). The groups fed with T₂ and T₃ recorded feed efficiency of 1.44 and 1.49 respectively. A lower feed efficiency of 1.53 was observed in T₄. The mean feed efficiency of broilers at fourth week was 1.80, 1.87, 1.86 and 2.00 for T₁, T₂, T₃ and T₄ groups respectively. A better feed efficiency of 1.80 was observed in T₁ (fed with UQPM 15 X UQPM 10). The groups fed with T₂ and T₃ recorded feed efficiency of 1.87 and 1.86 respectively. A lower feed efficiency of 2.00 was observed in T₄. The mean feed efficiency of broilers at fifth week was 2.14, 2.32, 2.25 and 2.32 for T₁, T₂, T₃ and T₄ groups respectively. A better feed efficiency of 2.14 was observed in T₁ (fed with UQPM 15 X UQPM 10). The groups fed with T₂ and T₃ recorded feed efficiency of 2.32, and

2.25 respectively. A lower feed efficiency of 2.32 was observed in T4. The mean feed efficiency of broilers at sixth week was 1.73, 1.74, 1.55 and 1.77 for T1, T2, T3 and T4 groups, respectively. A better feed efficiency of 1.55 was observed in T3 (fed with UQPM 11 X UQPM 9). The groups fed with T1 and T2 recorded feed efficiency of 1.73, and 1.74 respectively. A lower feed efficiency of 1.77 was observed in T4.

The cumulative mean feed efficiency of broilers for the period of 0-6 weeks of age were 1.78, 1.83, 1.78 and 1.89 for T1, T2, T3 and T4 groups respectively. A better feed efficiency of 1.78 was observed in T1 and T3 (fed with UQPM 15 X UQPM 10 and UQPM 11 X UQPM 9). The groups fed with T2 recorded feed efficiency of 1.83. A lower feed efficiency of 1.89 was observed in T4 (Table 3).

During 0-2week period, the birds fed with UQPM5XUQPM14 gained maximum weight (T2, 97.33g) whereas the birds fed with COH (M) -5 gained minimum weights (T4, 86.00g). Then, during 2-3week period, the birds fed with UQPM 15 X UQPM 10 and UQPM 5 X UQPM 14 gained maximum weight (T1, 327.00g and T2 320.00g respectively) whereas the birds fed with COH (M) 5 gained minimum weight (T4, 301.67g). 3-4week period, the birds fed with UQPM 15 X UQPM 10 gained maximum weight (T1, 380.00g) whereas the birds fed with COH (M) -5 gained minimum weight (T4, 341.00g). During 4-5week period, the birds fed with UQPM 15 X UQPM 10 gained maximum weight (T1, 411.33g) whereas the birds fed with COH (M) -5 gained minimum weight (T4, 379.33g). During 5-6week period, the birds fed with UQPM 11 X UQPM 9 gained maximum weight (T3, 503.33g) whereas the birds fed with COH (M) -5 gained minimum weight (T4, 443.33g). From 0-6week period, treatment T3 gained maximum weight of (T1, 1826.67g) followed by T2 and T3. Weight gain in all hybrids differs significantly from that of control, T4 (1570.00). Hence treatment T1 considered best among other hybrids followed by T3 (UQPM 11XUQPM 9), T2 (UQPM5XUQPM14) and control T4 (COH (M) -5). Similar to these findings, dietary replacement of NM by QPM significantly increased weight gain of days 21-42, 42-49 and 1-49. Meanwhile, feed efficiency was greatly improved ($P < 0.10$) as indicated by Bai, 2002; Gao, 2002 and Zhai, 2002.

CONCLUSIONS

The feed intake of broilers is not significant between the treatments, but feed conversion ratio differs significantly. During the second week, a better feed efficiency of 1.51 was observed in T2 (fed with UQPM5XUQPM14) and third week, a better feed efficiency of 1.41 was observed in T1 (fed with UQPM 15 X UQPM 10). From fourth week up to sixth week also a better feed efficiency was observed in T1 (fed with UQPM 15 X UQPM 10). For the cumulative mean feed efficiency of broilers from 0-6 weeks, a better feed efficiency of 1.62 was also observed in T1 (fed with UQPM 10 X UQPM15). Hence treatment T1 considered best among other hybrids followed by T3 (UQPM 11 X UQPM 9), T2 (UQPM 5 X UQPM 14 and control T4 (COH (M) 5). Similar to these findings, the QPM based diet increased feed intake of birds remarkably ($P < 0.10$). It implies that QPM may contain something which has good appetite in addition to grain lysine content as indicated by Zhai (2002). Higher grain lysine content in QPM mainly contributes to the feeding benefits of QPM, as suggested by Sullivan (1989) and Burgoon (1992).

REFERENCES

1. Bai, Xue-Feng. (2002). *Nutritional evaluation and utilization of quality protein maize Zhong Dan 9409 in broiler feed.* (Unpublished post graduate thesis), Chinese Academy of Agricultural Sciences, Beijing 100081, P. R. China
2. Burgoon, K. G., J. A Hansen, D. A. Knabe, and A. J. Backholt. (1992). *Nutritional value of quality protein maize for starter and finisher swine. J. Anim. Sci.* 70:811-817.

3. Gao, Jun.(2002). *Nutritional evaluation and utilization of quality protein maize Zhong Dan 9409 in pig feed.* (Unpublished Post graduate thesis) Chinese Academy of Agricultural Sciences, Beijing 100081, P. R. China.
4. Lopez-Pereira MA (1993). *Economics of Quality Protein Maize as a Feedstuff.* *Agribusiness* 9: 557-568.
5. Ortega, E. I., E. Villegas, and S. K. Vasal.1986. *A comparative study of protein changes in normal and quality protein maize during tortilla making.* *Cereal Chem.*, 63(5):446-451.
6. Osei, S. A., H. K. Dei and A. K. Tuah.1999. *Evaluation of quality protein maize as a feed ingredient for layer pullet.* *J. Anim. Feed Sci.* 8:181-189.
7. Sproule, A. M., S. O. Saldivar, A. J. Bockholt, L. W. Rooney and D. A. Knabe. 1988. *Nutritional evaluation of tortillas and tortilla chips from quality protein maize.* *Cereal Foods World.* 33(2):233-236.
8. Sullivan, J. S., D. A. Knabe, A. J. Bockholt, and E. J. Gregg. 1989. *Nutritional value of quality protein maize and food maize for starter and growth pigs.* *J. Anim. Sci.* 67:1285-1292.
9. Zhai, Shao-Wei (2002). *Nutritional evaluation and utilization of quality protein maize Zhong Dan 9409 in laying hen feed.* (Unpublished post graduate thesis), North western Agricultural and Forestry University of Science and Technology, Shaanxi 712100, P. R. China.

Table 1: Feed Requirements

Days	Starter without Maize (G/Chicks)	QPM Hybrids (G/Chicks)
11-14	24.5	24.5
15-21	33	33
	Finisher without Maize (g/chicks)	
22-28	29.4	68.6
29-35	37.8	88.2
36-42	34.5	80.5

Table 2: Effect of Dietary Treatment on Performance of Broilers for 0-6 Week

Weeks	Treatment	Average Weight** (G)	Weight Gain** (G)	Feed Intake ^{NS} (G)	FCR**
0-2	T1	282.71 ^c	86.67	146.67	1.68
	T2	292.10 ^b	97.33	143.67	1.51
	T3	279.48 ^d	93.67	146.33	1.55
	T4	275.57 ^e	86.00	145.33	1.67
2-3	T1	607.80 ^c	327.00	460.00	1.41
	T2	611.93 ^b	320.00	460.33	1.44
	T3	604.94 ^d	310.00	461.67	1.49
	T4	574.10 ^f	301.67	462.00	1.53
3-4	T1	989.67 ^b	380.00	685.67	1.80
	T2	980.57 ^b	367.00	685.33	1.87
	T3	957.93 ^{bc}	367.00	683.33	1.86
	T4	910.03 ^c	341.00	683.67	2.00
4-5	T1	1438.43 ^b	411.33	881.33	2.14
	T2	1359.77 ^d	380.67	882.00	2.32
	T3	1353.30 ^d	391.00	880.67	2.25
	T4	1296.33 ^e	379.33	881.00	2.32
5-6	T1	1829.00 ^d	453.33	783.00	1.73
	T2	1826.67 ^d	450.00	784.00	1.74
	T3	1845.33 ^c	503.33	782.00	1.55
	T4	1743.53 ^e	443.33	784.00	1.77

UQPM15 XUQPM 10 (QPM Hybrid) + Regular Feed Without Maize (**T1**),

UQPM5 XUQPM 14 (QPM Hybrid) + Regular Feed Without Maize (**T2**),

UQPM11 XUQPM 9 (QPM Hybrid) + Regular Feed Without Maize (**T3**),

COH (M) 5+ Regular Feed Without Maize (**T4**)

Table 3: Overall Performance of Broiler 0-6 Week

Overall Performance (0-6 Week)	Treatment	Weight Gain** (G)	Feed Intake ^{NS} (G)	FCR**
	T1	1663.33 ^{cd}	2961.00	1.78
	T2	1613.33 ^d	2960.00	1.83
	T3	1666.67 ^c	2959.67	1.78
	T4	1570.00 ^e	2959.33	1.89
	Mean	1666.11	2959.94	1.7794
	SE. d	19.5742	0.4635	0.0187
	CD(.05)	43.6142	1.0327	0.0417
	CD(.01)	62.0390	1.4690	0.0593
	CV%	1.44	0.02	1.29

UQPM15 XUQPM 10 (QPM hybrid) + Regular feed without maize (**T1**),

UQPM5 XUQPM 14 (QPM hybrid) + Regular feed without maize (**T2**),

UQPM11 XUQPM 9 (QPM hybrid) + Regular feed without maize (**T3**),

COH (M)5 + Regular feed without maize(**T4**).

